Clinical Lecture

ON THE

OBLITERATION

OF

VARICOSE VEINS,

AND THE

SOURCES OF DANGER INVOLVED IN THAT OPERATION.

DELIVERED AT

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MDCCCLIII.

VARICOSE VEINS.

Gentlemen,—On Monday last I drew your attention to the mode of operating for the obliteration of varicose veins, and to the sources of danger involved in that operation. I explained to you that the operation which I performed consisted of two parts, viz., 1st., that of introducing a needle under the trunk of the vein to be obliterated, and leaving it there for a few days; 2ndly, at the expiration of that time, when the blood on either side of the needle had become coagulated, the operation was completed by dividing the vein by a subcutaneous incision. This latter part of the operation I have now performed.

I would now explain to you a little more at length the reasons which induce me to adopt this mode of operating, and also, as immediately connected with the same subject, I will consider the effects produced upon the system by the decomposed contents of a vein when accidentally received into the circulation. This latter subject is far from being as yet fully understood. But it is one the importance of which is gradually becoming more and more acknowledged, and the facts that we do know concerning it are so full of interest, that they must commend themselves to the attention of all who wish their knowledge of surgery, and its effects, to extend below the surface of the body.

When a needle is placed under a vein, and a twisted suture applied around its extremities, the vein is in much the same condition as if a ligature were applied to it; and we may judge of the process that takes place in the human

subject by that which happens when a ligature is applied to a vein in an animal. When this is done in a horse, the first effect is the stagnation of the blood on each side of the obstruction. The stagnant blood generally coagulates, if the ligature be allowed to remain, during the first twenty-four hours. We have then the vein compressed at one point, and a clot of blood between the ligature and the next communicating branch on each side. But the coagulum is apt to extend much further upon the distal side than upon the side next the heart, because the vessels which supply the tied vein, not being able to empty themselves, are liable also to become distended with coagulated blood. For this reason, it sometimes happens that a long coagulum is formed in the distal portion of the vein, filling it to distension, while the portion next the heart is perfectly empty and collapsed.

A ligature upon a vein does not divide its internal coat, either in man or animals, as happens when an artery is tied. At most some superficial abrasion is produced of the internal tunic. The coats of a vein are by a ligature drawn into longitudinal folds, and a visible line of indentation is produced. The coagulum of blood formed within the vessel moulds itself completely to the shape of the vessel in which it is contained, and bears the marks of the longitudinal folds of the lining membrane, and of its semilunar valves. This inherent power of the blood accurately to adapt itself to every inequality, and completely to close the vessel, is a very remarkable quality. It is one of the living processes accomplished by the blood which we can trace, and by which we are prepared to understand, other more subtle operations in the animal economy which are more hidden from our observation.

The first effect of the formation of such a coagulum is to prevent any hæmorrhage, in case the vessel should be subsequently divided by ulceration or by other means. It also serves the very important office of preventing any fluids from passing along the canal of the vessel, which might prove prejudicial to the system. But a coagulum of this sort is not to be regarded in its mechanical relations alone. It is not a simple plug of foreign matter; it is still a part of the living being, and capable of undergoing many and most important living changes. Some of these are engendered within the confined blood itself, while others are common to it and the surrounding parts. It has, I am aware, been the custom to consider coagulated blood as no longer a part of the living being. Some physiologists have regarded the coagulation of the blood as the act of death; others have looked upon it as the last act of life. Both these ideas have evidently

arisen from the action having constantly been observed out of the body, where undoubtedly the separated portion of blood does die. But when we consider, that the conversion of blood into muscle, in the ordinary process of nutrition, is but a modified act of coagulation, it will readily be admitted that the coagulation of a portion of blood by no means necessarily involves its death. In the experiments which Hunter performed of transplanting one portion of an animal (as a tooth or a testicle, for example) into another living being, he had a much higher object in view than the gratification of his curiosity. Although he doubtless was interested and amused to see the tooth of a man growing from the comb of a cock, yet he saw more than this. He saw in it the great principle, that every part of an organised structure is endowed with its own life, and, although incapable of continued separate and independent existence, he inferred that each separate part might live for a certain time; that, in the case of the tooth, for instance, it would retain its vitality when separated from the rest of the body, until it had formed fresh connexions in its new situation. Now, these principles, (extending as they do to every part of the animal system,) you will at once perceive, are applicable to our present subject. The blood alone forms no exception to the general rule. It may for a time retain its vitality, whether in a solid or a fluid form, when separated from the circulating mass. But as it may live and undergo further changes in harmony with the well-being of the part and of the system, so may it die, or become subject to certain morbid actions, and thus be a source of danger to both. We have here, then, two distinct classes of cases; one, in which the separated blood undergoes changes which issue in the reparation of the injury inflicted upon the vein; the other, in which, from some defect in the system, or from some vice in the composition of the blood, the natural and healthy process of repair is not carried out. It will be my endeavour, if time permit, to trace very briefly both these actions (the healthy and the unhealthy) through some of their more ordinary forms. After a portion of the blood has become separated and coagulated, it adheres to the surfaces with which it happens at the time to be in contact. The adhesion thus formed is at first very slight, but it gradually becomes much firmer. The coagulum itself is sometimes solid throughout; at other times it is less consistent and broken; but it always fills the cylinder of the vein. After a ligature has been applied to the jugular vein of a horse, for the first five days there is no blush upon its lining membrane. No signs of adhesive inflammation, —that is, of lymph secreted from inflamed vessels,—can

in any part be observed in the interior of the vein. Up to this period, there is no thickening of the proper coats of the vein, and no agglutination of the contiguous folds of membrane. The situation of the ligature is simply marked by a dense white line. But the cellular structure around is thickened by the deposit of lymph. If two ligatures be applied, and the vein divided between them, the cut edges will recede for about an inch ; but the process which goes on in the interior of the vein will not materially vary from that above described. At the expiration of a week, a layer of lymph is effused around the ligature, enfolding it in a kind of sheath. After this, ulceration of the coats of the vein commences, and, if the ligature is allowed to remain, continues till the coats of the vein are completely divided. The ulcerated edges at this time adhere firmly to the surrounding cellular sheath, which is thickened by a deposit of lymph. The calibre of the vein at this time has not undergone any diminution or contraction ; so that it may happen, that after a ligature has traversed a vein, and the coagulum which it contained has been dissolved or absorbed, the circulation through it may be completely re-established, the ulcerated sides of the vein being represented by the condensed and thickened cellular sheath.

You will now perceive one object which I had in view in dividing the vein by a subcutaneous incision in the patient who has just left, instead of allowing the needles to ulcerate their way out. By such an operation the vein is allowed at once to retract. A pad being then applied, the surrounding areolar tissue is made to occupy the place of the vein, and, uniting there by adhesive inflammation, it prevents the venous channel from becoming re-established.

During the time that the changes which I have attempted to describe are going on in the coats of the vein, other important actions may be going on in its contents. It is necessary, however, to remark, that these changes occur more readily in smaller than in larger animals, and the time required for the coats of the vein to become ulcerated through, is less in the human subject than in the horse, where we have the best opportunities of observing the different stages of this process.

When the blood has become stagnant in an obstructed vein, if its coagulating power be unimpaired, it will occasionally happen that the whole of the blood will form a solid mass. This will adhere to the sides of the vein, and completely obstruct its canal.

At other times, the outer layer of blood alone will form itself into a kind of membrane, which will adhere and become incorporated with the sides of the vein. It will occasionally

happen under these circumstances, that the blood in the centre will remain fluid, or will be very loosely coagulated. The less consistent portions may then be removed, and carried in the course of the circulation, leaving a cylinder of fibrine coating the vein, through which the circulation of the part may be re-established. Now, all these actions may, and do go on without any signs of inflammation, and without any constitutional disturbance. The changes are produced in the fibrine of the blood, which forms a bond of union between the opposed sides of the vein, and obliterates its canal. This obliteration may be temporary or permanent; but, in either case, the material used is derived from the blood itself, and is not the product of inflammation. Thus the canal of a vein may be obstructed by a coagulum; that coagulum may become partially organised or absorbed, or its constituents may be dissolved and carried in the course of the circulation, without any preternatural excitement in the part, or in the system at large. The whole process is conducted without any sign of inflammation, properly so called, and without any unnatural appearance of vascularity of the lining membrane of the vein.

Provided the blood be in a healthy condition, and unmixed with any morbid secretion, the veins consequently may be cut, bruised, or lacerated without any evil consequences. Healthy reparation is produced first by the temporary obstruction of the veins, and then by the removal of that obstruction in one of the ways above-mentioned.

But it will sometimes happen through some morbid condition of the blood itself, or in consequence of the introduction of some vitiated secretions into it, that an unhealthy action is set up. Any morbid matter generated or introduced into the cavity of a vein, has no means of escaping through its dense parietes, and the inflammation and irritation which may then be set up is as great as any that can be produced in any part of the living body. Let me illustrate this in reference to the case upon which I have just operated. Let us suppose that, instead of a healthy coagulum of blood, the contents of the vein had become mixed with some purulent secretion of the part, or that a portion of the fibrine confined within the vein had undergone some degree of decomposition, the healthy and natural actions of the parts would then immediately be disturbed, the skin would become red, the cellular tissue distended, and the whole track of the vein extremely painful. At the same time there would be great constitutional irritation, the pulse and respiration would become excited, and there would be other symptoms of fever, the character of which would vary according to the local changes which took place in the obstructed vein.

The first question which we naturally ask under such circumstances is, supposing there to be some unnatural fluid in the vein, how is that to be got rid of? If there be an external opening in the vein, it may escape in that way; and this is what happens when a wound made in bleeding opens again, and allows the grumous dark-coloured contents of the vein to escape. But it often happens that morbid matter may be retained in a vein where there is no external opening by which it can escape. It is natural to suppose, that, under such circumstances, it would find its way along the channel of the vein into the general circulation; and this, in reality, occasionally happens, and doubtless affords an explanation of the sudden, severe, and even fatal symptoms which have sometimes followed an apparently trifling operation on a vein. It is for the purpose of avoiding any such accident that I have adopted the plan of operating which I have described. I have thereby the means of ascertaining, before any opening is made in the vein, whether the blood has its natural power of coagulating, and whether the channel of the vessel is closed. If this be the case, a portion of fibrine may decompose in a vein, or purulent secretions may be introduced into it, and only a local irritation will be produced, unattended with any serious symptoms. But should the canal of the vein not be closed, and these same morbid products find their way through it into the general circulation, the most alarming symptoms will result. Some fifty or sixty years ago, when the operation of tying varicose veins without any previous preparation was in vogue, it occurred to Sir E. Home to have a private patient on whom he performed the operation of tying the saphena vein. Symptoms of typhoid fever set in, and terminated fatally in two or three days. About the same time, two other cases occurred in St. George's Hospital, where, after the operation of tying the saphena vein, similar symptoms manifested themselves, and the patients narrowly escaped with their lives.

Sir B. Brodie, upon whose authority these cases are given, not being satisfied with an operation which was occasionally followed by such consequences, suggested a modification of it. He introduced a very thin knife under the skin, and divided the vein by subcutaneous section. This operation, for a time, appeared to answer; but a case at length happened in which the patient died four days after the operation. After this, so great was the fear of wounding the saphena vein, that no surgeon in London ventured to perform the operation for several years. Indeed, up to the present time, something like a superstitious dread is entertained generally respecting the ligature of veins, without,

however, any distinct ideas having been given as to the real source of danger in such cases.

In pursuing some investigations relative to this subject, I was induced to believe that the decomposed and putrid fibrine of the blood was the real cause of the very serious symptoms in these cases; but, being at a loss to know what the effects of putrid fibrine were upon the animal system, and having been able to obtain no information upon this subject from any published work that I was acquainted with, I determined to try what the result of the introduction of such a fluid into the vascular system would be. Accordingly, having obtained the assistance of a veterinary surgeon, and having obtained some fibrine in a very putrid condition, I caused an ounce of the decomposed fluid, mixed with an equal quantity of water, to be injected into the jugular vein of a donkey. The fluid passed without obstruction into the course of the circulation, and in a few moments the animal gave three or four groans expressive of great distress. The vital powers appeared to be suddenly prostrated; the animal lay unable to rise, and soon fell into a state of syncope. This lasted a few minutes. On getting up, the animal reeled and staggered about, but subsequently recovered sufficiently to walk to his stable. Some re-action now commenced; the breathing was disturbed, short, and quick; the pulse, which naturally beats about 36 in the minute, rose to 120. These symptoms continued about an hour and a half. After this, the animal became very restless and uneasy, and evinced internal pain by groaning and looking at his side. The animal died four hours after the operation. On a *post-mortem* examination, the jugular vein, into which the decomposed fluid had been injected, was found in its natural condition, and partially distended with fluid blood. It was pervious throughout its whole length, and contained no coagula. The lungs were found studded with irregularly-circumscribed soft black patches. When cut into, these discharged a blackish fluid, having the appearance of a mixture of blood and ink, and of a strong putrid smell. The cœcum and colon, and a portion of the small intestines, were deeply congested, and of a dark livid colour.

In this instance, the decomposed fibrine evidently acted as a most virulent poison upon the system. In fact, there are few animal poisons known which would produce such serious effects in the same space of time. But it will be asked, if such serious effects follow the introduction of putrid fibrine into the circulating system, how is it that these results are not oftener manifested, seeing that the blood must constantly be liable to its influence? This must constantly

happen in cases of sloughing wounds, and in cases of abscesses in the course of inflamed veins.

In healthy states of the constitution, the system is preserved by a very wonderful provision, and one which could not have been anticipated, I presume, by any process of reasoning. The blood has itself the power of fixing some morbid matters that come in contact with it, and, by entering into a kind of combination with the first particles that present themselves, it effectually seals the vessels against the entrance of any further portions. It is indeed generally conceived, that putrid fluids mixing with the blood prevent its coagulation; and this I believe to be generally true. But the effect of slightly decomposed fibrine upon the blood offers a marked and very peculiar exception to this rule. The blood in the living being is, as I have said, peculiarly liable to the influence of putrid fibrine; and it is in perfect accordance with the usual economy of nature to find the sensibilities of a part actively alive to those influences which are calculated to affect it injuriously. Now, the sensibilities of the blood for its self-preservation will be found, upon examination, to be as evident as those of other parts of the body, and to be called into operation in an especial manner with regard to the action of putrid fibrine.

The following experiments will show how readily the presence of such decomposed fibrine is felt by the living blood, and will also illustrate the means employed for the preservation of the system from its injurious and poisonous influence. Having obtained some fibrine quite firm and free from any colouring matter, I allowed it to decompose till it became fluid. A small quantity of this was mixed with some recently drawn blood, and in less than two minutes the mixture had formed a uniform soft coagulum. This experiment was repeated upon some blood drawn from a healthy horse, with a similar result. Now, these experiments show that the action of putrid fibrine upon the blood is similar to that of pus. If pus be mixed with recently drawn blood, it will have the effect of coagulating it in about two minutes; but if injected into a vein, the coagulation will take place almost immediately. This is known by the thickened and cord-like feeling of the vein, and by the circulation through it being obstructed. It is evident that the effect of such an action must be to prevent the morbid matter from passing into the circulation. The putrid fibrine or the pus unites with the first portions of blood with which they come in contact. They form with it a coagulum, which adheres to the sides of the vessel in which it is contained, and effectually seals it against the entrance of any further portions of morbid matter. The irritating substance is thus fixed

and localised to that portion of the vascular system, where it is first formed; and, although it may produce a considerable amount of irritation and suppuration here, yet, if the coagula formed be sufficiently firm, the system will be preserved. A local inflammation alone will be produced, and the poisonous effects of the morbid matter will not be felt by the constitution. A practical illustration is here presented of a principle long and perseveringly advocated by Dr. Wilson, of St. George's Hospital, namely, that the coagulation of the blood out of the body is only a feeble expression of its much more energetic action in the living system. The one act of its changing its form when withdrawn from the body, is the last expression of that wonderful power, by which, while in the body, it is constantly changing its form from the fluid to the solid, and from the solid to the fluid, in the various processes of growth, nutrition, and decay. It was the consideration of this power, as evinced in the preservation of the system from the effects of the circulation of purulent fluids, that led me to adopt the plan of ascertaining that the vein was obstructed before dividing it in the operation for varicose veins. As nature adopted this plan of preventing the absorption of vitiated fluids when formed, it appeared to me, that increased security would be given, if it were ascertained that a firm coagulum obstructed the vein before its coats were injured. This is effected by the simple expedient of keeping the blood at rest for a certain time in a vein; and by the mode now adopted, we have the great advantage of insuring that the coagulum is composed of blood alone, and not blood in combination with pus or other vitiated fluid. This may be a point of considerable importance, for a time comes when the portions of the coagulum are dissolved and carried in the course of the circulation. If formed from healthy blood, this process is attended with no constitutional disturbance; but if the coagula have been partly composed of vitiated fluids, a train of symptoms may be induced which exercise most important influences upon the system.

If the quantity of vitiated fluid mixing with the blood be large, or if it be in an advanced stage of decomposition, the coagulum by which it is retained may be very loosely formed. The central portions will then become softened down, more or less deprived of their colouring matter, and converted into a fluid resembling pus. As the process of softening proceeds, the coagulum which first formed becomes gradually of less consistence, and at length the vitiated fluid contained in its centre escapes, and is poured into some of the adjacent veins. It here determines, under ordinary circumstances, one of the three following physical results.

First. The dissolved matter, which has often the appearance of pus, mixing with fresh portions of blood, may determine the formation of fresh coagula. These may retain the vitiated fluid, and, adhering at intervals to the sides of the vein, they may for a time prevent any of the morbid matter from reaching the general circulation. Within a short period, however, the centres of the newly-formed coagula will become softened and gradually deprived of their colouring matter. The process of softening will proceed from the centre towards the circumference of each portion, until the greater part, or the whole, is converted into a thick fluid, resembling pus. This fluid it is which has been so often mistaken for pus in the veins.

Secondly. The blood that has been infected, instead of coagulating, may separate into its different elements. The fibrine in this case separates from the rest, and, allowing the serum and colouring matter of the blood to pass on, may adhere to any part of the vascular system with which it comes in contact. The vessel in which the adherent fibrine is contained is not completely obstructed, as happens when the blood coagulates in a vein. The difference is this, that in one case the fibrine alone of the blood is detained, and in the other all the parts of the blood are contained in the clot. In the first case, the circulation can be still carried on between the fibrinous deposit and the opposite side of the vein; in the second, the calibre of the vessel is completely obstructed. An instance of this form of contaminated blood presented itself a short time ago in this hospital in an old man who had a large tumour removed from the back part of the arm. A few days after the operation, he was attacked with erysipelas, which terminated in mortification of the part and death. In that case I had an opportunity of pointing out to those gentlemen who witnessed the *post-mortem* examination, that the axillary vein and its branches were about half filled with firm portions of decolorised fibrine, which had evidently formed before death, and by the side of which the circulation of the limb had for a time been maintained. In this instance the blood in the immediate neighbourhood of the wound was of a very black colour, and quite fluid.

Another remarkable instance of this form of diseased blood came under my care in the hospital during Mr. Fergusson's absence in September last. A man, aged 37, was admitted, having six months previously fractured his patella; after which, although he was enabled to walk, he always experienced a sense of stiffness in the joint. On September 17, he was attacked at two o'clock in the morning with a succession of rigors, which continued until the middle of that day. An abscess subsequently formed in the knee-joint, and

the cellular tissue between the muscles of the leg and thigh were extensively infiltrated with pus. The shiverings were repeated on several days after his admission into the hospital, and were followed by most profuse and exhausting perspirations. He died on the 16th of October. On a *post-mortem* examination the patella was found to be softened in its interior; one part of its posterior surface was rough and carious, and lying in contact with this exposed surface was a small detached portion of dead bone. The profunda vein was found to be filled with coagula, but the superficial femoral contained only a small quantity of fluid blood. At the junction of the two (and this is the point to which I wish particularly to direct your attention) was a considerable mass of white adherent fibrine. This was easily removed from the lining membrane of the vein, which then presented its natural polished appearance. No signs of inflammation of the lining membrane could be discovered. The portion of decolorised fibrine to which I have referred was removed from the vein, and when pressed between the fingers a small quantity of white purulent-looking matter escaped from its interior. At the lower part of the right lung were several small oval deposits of white matter, as firm in consistence as ordinary tubercle. In other parts of the same lobe were larger indurated masses, containing in their centres discoloured purulent-looking fluid. The point of the greatest interest in this case is, that, upon a microscopical examination, the appearances of the white fluid from the clot in the vein accurately resembled that from the secondary deposits in the lung. We therefore naturally come to the conclusion, that, in both these situations, the purulent-looking fluid was formed in the same way, and that the same action which produced its development in the fibrine after it had travelled from the seat of injury to the termination of the profunda vein, produced its developments in the lung, at a still greater distance from the original source of mischief.

The third physical change that may take place in contaminated blood is, that it may decompose: instead of coagulating or of separating into its different elements it may become putrid in the vessels of the body. The whole of the constituents of the blood are then involved in the changes which take place. Fortunately, we have few examples of this disease in the London hospitals at present; but during the prevalence of severe epidemics they are not so very uncommon. In the severer forms of puerperal fever especially, the whole mass of the blood appears to be contaminated, and, wherever it stagnates, it shows a tendency to decompose. Any organ attacked in this state of the system

will pass most rapidly into a state of gangrene. In a single day an organ may become attacked, its structure softened and broken down, and it will then present the characters of a putrid abscess.

Not long ago I had the opportunity of examining a case of a woman who miscarried during the sixth month of her pregnancy. A few days afterwards, she was attacked with intense pain in the abdomen, and, two or three days later, with pain in the calf of the left leg. The pain in the leg was accompanied by swelling, which afterwards extended up the thigh. She died shortly after the attack. Upon examining the body after death, a small putrid abscess occupied the course of one of the branches of the hypogastric vein, at a short distance from the neck of the uterus; the iliac and femoral veins of the same side were filled with blood in every stage of decomposition; the spermatic vein of the same side was stained of a dark purple colour, but its canal was pervious, and contained no coagula.

The remarks which I have now made have reference to contaminated blood generally whenever the morbid matter is derived from purulent secretions or from putrid fibrine. The examples are now rare in which these forms of blood disease present themselves after injury to the superficial veins of the body; but formerly, when bleeding was more practised than it is at present, cases of the kind were not very uncommon. In the operation of obliterating varicose veins, no example of any severe disease has presented itself hitherto in this hospital; but, as fatal cases do occasionally occur, it is well to take every precaution. In the operation which I have recommended, all the usual sources of danger are, I believe, guarded against. We have the means of ascertaining before the vein itself is injured, that its cavity is obliterated; and we may judge of the firmness of the coagula which it contains. Should the coagulum of blood not form in any case after the introduction of the needles below the vein, in such an instance I certainly should decline to proceed with the operation. I should consider that, from some cause or other, the coagulating power of the blood was deficient, and that there was no security that any morbid matter which might accidentally be formed in the part would not be conveyed along the channel of the vein into the general circulation.

It might at first appear an objection to this mode of operating, that it required a longer time than if the operation could be performed at once; but this is not the case. I have here the notes of a case which I recently treated in this way. A woman was admitted into this hospital on the 29th of September last, with a large cluster of veins on the inner

side of the right leg, and one very large vein extending up the inner side of the thigh.

On the 2nd of October, a needle was introduced behind the cluster of veins in the leg, and also behind the enlarged vein in the thigh.

On the 5th, the needles were removed, and the veins divided by subcutaneous incision.

On the 9th, she was enabled to leave her bed; and on the 17th she left the hospital.

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